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91-04562/

**FIELD PERFORMANCE OF THE GROWTH
REGULATOR UNICONAZOLE**

Report No 90-284-K

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ABSTRACT

Measurements were taken in 1990 of the growth of Norway maple and green ash trees that were trunk injected with the growth regulator uniconazole in the spring of 1988. The growth of green ash, measured by the increase in overall height and trunk diameter, was inhibited by 57 and 41% respectively, in 1990 and by 55 and 34%, respectively, for 1988 through 1990. The increase in trunk diameter of Norway maple was inhibited significantly in both 1990 and for the period 1988 through 1990.

job	file	date	report no.
34-553-031	834.1	November 29, 1990	90-284-K



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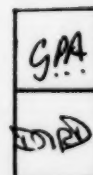
EXECUTIVE SUMMARY

FIELD PERFORMANCE OF THE GROWTH REGULATOR UNICONAZOLE

G.P. Arron

A field study, requested by Retail Delivery Systems Department, was initiated in 1988 in which trunk injection of the growth regulator uniconazole is being evaluated as an inhibitor of the growth of trimmed trees. A reduction in the rate of regrowth of trees under or beside distribution lines would allow the frequency of trimming to be reduced. Norway maple and green ash trees (in Toronto and London, respectively) were trimmed and trunk injected with uniconazole in June 1988.

Observations made in the fall of 1990 suggested that green ash trees treated with uniconazole exhibited premature abscission in that they had undergone partial defoliation when compared with untreated trees. Similar observations had been made in 1989. No such effect was seen in the Norway maple trees in 1990. With the exception of the increase in height of the Norway maple trees, the inhibition of growth (measured as increase in height or increase in trunk diameter) of the two species ranged from 34 to 55% for the three growing seasons 1988 through 1990 combined. Again with the exception of the increase in height of the Norway maple, there appeared to be no decline in the level of inhibition of the two measures of growth in the two species for the 1990 growing season compared with the previous two seasons. For the application of growth regulators to be a useful method of extending trim cycles a longevity of effect has to be demonstrated. From the results of this project to date it would appear that the application of uniconazole shows promise as such a method.



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TO: Dr. D. Mills
Director of Research

FIELD PERFORMANCE OF THE GROWTH REGULATOR UNICONAZOLE

1.0 INTRODUCTION

A field study, requested by Retail Delivery Systems Department, was initiated in 1988 in which trunk injection of the growth regulator uniconazole (XE-1019) {(E) - 1 - (4 - chlorophenyl) - 4, 4 - dimethyl - 2 - (1, 2, 4 - triazol - 1 - yl) - 1 - penten - 3 - ol} is being evaluated as a method of inhibiting tree growth in trimmed trees growing in Southern Ontario. Norway maple (Acer platanoides L.) and green ash (Fraxinus pennsylvanica Marsh.) trees, growing in Toronto and London respectively, were trimmed and trunk injected with uniconazole in the spring of 1988.

Various measurements of growth were taken in 1990 and are discussed in this report, as well as growth data for the entire 1988 to 1990 period. More information on this growth regulator project has been provided previously (Arron, 1988, 1989a) and a general discussion of the role growth regulators might play in Ontario Hydro tree trimming operations is provided in Arron (1991).

This field project was funded by Retail Delivery Systems in both 1988 and 1989. No funds were provided in 1990 for several reasons, including the question of the economics of growth regulator use in operational tree trimming, and concerns from the public over the use of pesticides by Ontario Hydro (see Arron, 1991). This field project was continued because it was felt that useful information could be obtained for both Ontario Hydro and the many utilities in North America who still have an interest in growth regulators.

2.0 MATERIALS AND METHODS

Details on the two field sites, the trimming and trunk injection procedures, the experimental designs, the assessment of tree defoliation and the measurement of growth have been described previously (Arron, 1988, 1989a). The green ash trees were located at Buchanan TS (called London in the text) and the Norway maple at Davenport and Lansdowne (Toronto). Growth measurements were taken at the two sites on October 3rd and October 4th, 1990 respectively.

3.0 RESULTS AND DISCUSSION

3.1 Effects of Uniconazole on Trunk Appearance

No bleeding injection holes or bark damage were observed in the green ash trees in London in 1990. From the time of injection to 1990 none of the injection holes in this species have bled (Arron, 1988, 1989a). Two holes in the Norway maple trees were bleeding slightly in the spring of 1990. This is in contrast to the situation at the same time in 1989 when fourteen (of a total of 29) holes were bleeding. This suggests that closure of most of these injection holes by callus growth had occurred. Bleeding in Norway maple has been reported previously (Curley, 1988). Two injection holes at Toronto had bark cracks associated with them, although in the case of one crack it appeared that it was the result of bark lifting at the time of injection. No bark splitting was observed above the injection holes. Watson (1988) reported that bark splitting occurred in 16% of holes in Norway maple injected by Potomac Edison in an experimental program. Examination of the Norway maple trees at Toronto revealed that the trunk of some treated trees had a very slight corrugated appearance - with the strips of trunk above each injection hole being the "valleys" and the strips above the points between two holes being the "hills". The bark of the latter had hair cracks in it, indicating cambial growth (Goodfellow, 1989) while the bark in the "valleys" had few cracks. Such a response has been observed before (see description of red oak (*Quercus rubra* L.) trees in Portland, Oregon injected with paclobutrazol by Portland General Electric - Arron, 1989b). Some of the trunks of the control Norway maple trees in Toronto also had such a corrugated appearance and so such uneven growth may be a normal growth pattern, and not always directly linked to injection with growth regulators. Uneven bark growth was not observed in the green ash trees in London.

3.2 Effects of Uniconazole on Tree Defoliation

The results of the subjective assessment of the degree of defoliation seen in the green ash and Norway maple trees in the fall of 1990 are presented in Table 1, with the results for 1989 shown for comparative purposes. From the treated versus untreated results for green ash in both 1989 and 1990 it appears that a result of the treatment was premature defoliation since there were more class 3 trees (50 to 100% defoliated) in the uniconazole group than in the control, while for the Norway maple no effect was apparent. It is doubtful whether premature loss of foliage will have any detrimental effect on the overall health of the trees. What may be more important is the delay of budbreak caused by uniconazole (and seen in the Norway maple in Toronto in 1990 - data not shown) which may limit the amount of photosynthate produced during the early stages of the burst of growth seen in the spring. Late budbreak is probably a greater problem from an aesthetic point of view, since it draws attention to treated trees.

Table 1

Defoliation in Norway Maple and Green Ash
Trees in the Fall of 1989 and 1990 following
Trimming and Trunk Injection with Uniconazole

Site	Species	Treatment	Class	Defoliation	
				Number of Trees 1989	1990

London	Green Ash	Control	1	11	4
			2	0	5
			3	1	3
London	Green Ash	Uniconazole	1	4	0
			2	6	2
			3	2	10
Toronto	Norway Maple	Control	1	6	5
			2	0	1
			3	0	0
Toronto	Norway Maple	Uniconazole	1	4	4
			2	1	1
			3	1	1

NB Data for 1989 from Arron (1989a).

3.3 Effects of Uniconazole on Increases in Height and Trunk Diameter

The effects of trunk injection of uniconazole on the increases in tree height and in trunk diameter (measured at breast height) in the Norway maple and green ash are shown in Table 2. In 1990 there was a significant inhibition of growth of the green ash measured by increase in height and increase in trunk diameter. In the Norway maple only the latter was affected. Similar results were obtained for the combined 1989 through 1990 growing seasons (Table 2). In the few studies with uniconazole in the literature, inhibition of growth (either increase in overall height, sprout length or trunk cross-sectional area) has been reported (Watson and Johnston, 1987; Sterrett, 1988; Liyembani and Taylor, 1989; Arron, 1990). There was no significant effect of uniconazole on the increase in height of the Norway maple trees in either 1990 or the combined 1989 through 1990 growing seasons. While all available trees were used at this Toronto site, the sample sizes are quite low, and a large variability in the response of the individual trees led to this result. One treated tree exhibited a large increase in height over the three years of the experiment (3.1 m) while all the remaining trees in the treated group exhibited growth of 1.5 m and less. Omission of this large tree from the group would result in the mean for 1990 dropping to 0.10 ± 0.08 m (from 0.24 ± 0.34 m - see Table 2) and for 1988 through 1990 to 0.93 ± 0.42 m (from 1.29 ± 0.97 m). The vigorous increase in height of this tree was due to escape or water sprouts growing at the top of the crown. Such sprouts, which appear to be unaffected by the treatment (while the majority of sprouts in the tree are) have been reported in various woody species treated with various growth regulators (Looney and McKellar, 1987; Gilliam et al. 1988; Wood, 1988). The measure of growth, increase in height, used in this study is a conservative measure. Unless the growth of most or all the sprouts in the tree is inhibited by the growth regulator the growth of a single unaffected sprout (or group) can give a large increase in height. Increase in trunk diameter of this particular tree did appear to be inhibited by the growth regulator (increase for 1988 through 1990: 1.9 cm, remaining trees in group ranged from 2.0 cm to 0.9 cm).

Inhibition of growth in the third season post-application of uniconazole showed no sign of decline from that seen in the previous seasons (Table 3). Inhibition of the increase in either height or trunk diameter was small in the green ash in the first growing season (1988), since the uniconazole was applied in late June in the middle of the burst of spring growth. Uniconazole also takes some time to be translocated to the young sprouts and foliage (Sterrett, 1988; Arron, 1990) although this may vary from species to species. With the exception of the increase in height of the Norway maple the inhibition of growth of the two species ranged from 34 to 55% for the combined 1988 through 1990 growing seasons (Table 3). Omission of the tree with long water or escape sprouts (see discussion above) from the treatment group would result in an inhibition of increase in height in the Norway maple of approximately 37% for 1988 through 1990. In Ontario trimming

Table 2

Increase in Height and Trunk Diameter of Norway
Maple and Green Ash Trees in 1990 and from 1988 through 1990
following Trimming and Trunk Injection with Uniconazole.

Site	Species	Treatment	-Increase in Height*-		-Increase in Trunk Diameter*-	
			1990 (m)	1988+89+90 (m)	1990 (cm)	1988+89+90 (cm)
London	Green Ash	Control	0.66±0.34	1.59±0.65	0.7±0.3	1.6±0.5
London	Green Ash	Uniconazole	0.29±0.21*	0.72±0.33*	0.4±0.2*	1.0±0.3*
Toronto	Norway Maple	Control	0.28±0.19	1.49±0.47	1.1±0.3	2.7±0.8
Toronto	Norway Maple	Uniconazole	0.24±0.34 ^{ns}	1.29±0.97 ^{ns}	0.7±0.2*	1.6±0.4*

*: Values shown are mean ± s.d. (n=12 at London, n=6 at Toronto).

: Mean value significantly different from value given directly above, determined by one-way analysis of variance (ANOVA), ns : not significant.

Table 3

Inhibition of Growth from 1988 to 1990 in Norway
Maple and Green Ash Trees following Trimming and Trunk
Injection with Uniconazole.

		-----Inhibition of Growth (%)'-----				
		-----Increase in Height-----			--Increase in Trunk Diameter--	
Site	Species	1988	1989	1990	1988+89+90	1988 1989 1990 1988+89+90
London	Green Ash	20	58	57	55	19 33 41 34
Toronto	Norway Maple	42	+14	13	13	42 44 42 43

*Inhibition calculated from the mean values given in Table 1.
NB A positive value (eg +14) represents a stimulation of growth.

cycles for trees under or beside distribution lines are relatively long compared to the southern states of the United States. For the application of growth regulators to be a useful method of extending such cycles a longevity of effect has to be demonstrated. From the results obtained in this study to date it would appear that the application of uniconazole shows promise as a method of extending trim cycles.

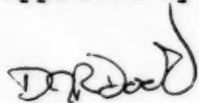
4.0 CONCLUSIONS

1. From observations made in the fall of 1989 and 1990 it appeared that green ash trees treated with uniconazole showed signs of early leaf abscission, with a greater degree of defoliation (than untreated trees).
2. With the exception of the increase in height of the Norway maple the inhibition of growth (measured as increase in height or increase in trunk diameter) of the green ash and Norway maple ranged from 34% to 55% for the combined 1988 through 1990 growing seasons.
3. In the third season after application of uniconazole the level of inhibition of increase in both height and trunk diameter of the green ash and the increase in trunk diameter of the Norway maple was either the same or greater than the level of inhibition seen in the previous two growing seasons.

ACKNOWLEDGEMENTS

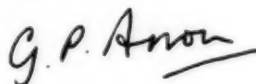
Excellent technical assistance was provided by Ms. L. Bremner and Dr. F. Camacho provided useful comments on statistical analysis.

Approved by:



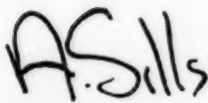
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BIBLIOGRAPHY

- Arron, G.P. (1988) Field Evaluation of the Growth Regulator Uniconazole (XE-1019). OHRD Report No 8-226-K.
- Arron, G.P. (1989a). OHRD Report No 88-226-K. Field Evaluation of the Growth Regulator Uniconazole (XE-1019) - Second Year Data OHRD Report No 89-281-K.
- Arron, G.P. (1989b). Report on the Inter-Utility Plant Growth Regulator Consortium Meeting held in Vancouver, WA. September 7-8th, 1989. OHRD Report No CB89-11-K.
- Arron, G.P. (1990). Translocation of Uniconazole after Trunk Injection of Silver Maple Saplings. J. Plant Growth Regul. 9, 141-146.
- Arron, G.P. (1991). Ontario Hydro: A Potential User of Tree Growth Regulators. J. of Arbor. (in the press).
- Curley, J. (1988). Current Tree Growth Results. Proceedings of the 3rd Annual Tree Growth Regulator Symposium, San Diego, CA. March 1-3, 1988. p72-76.
- Goodfellow, J. (1989). Personal communication to G.P. Arron.
- Liyembani, S. and Taylor, B.H. (1989). Growth and Development of Young Peach Trees as Influenced by Foliar Sprays of Paclobutrazol or XE-1019. HortSci. 24, 65-68.
- Looney, N.E. and McKellar, J.E. (1987). Effect of Foliage- and soil-surface applied Paclobutrazol on Vegetative Growth and Fruit Quality of Sweet Cherries. J. Amer. Soc. Hort. Sci. 112, 71-76.
- Sterrett, J.P. (1988). XE-1019: Plant Response, Translocation and Metabolism. J. Plant Growth Regul. 7, 19-26.
- Watson, M. (1988). Bark Splitting in Perspective, in Clipper Clips, Number 1, Monsanto Company, St. Louis, MO.
- Watson, M. and Johnston, P.A. (1987). Trees Growth Regulators - One Company's Experience. Proceedings of the Fourth Symposium in Environmental Concerns in Rights-of-Way Management, Indianapolis, IN. Oct 25-28, 1987, p540- 549.
- Wood, B.W. (1988). Paclobutrazol suppresses Shoot Growth and Influences Nut Quality and Yield of Young Pecan Trees. J. Amer. Soc. Hort. Sci. 13, 373-377.